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THE UNIVERSITY OF TEXAS AT AUSTIN
APPLIED RESEARCH LABORATORIES

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phone: (512) 836-1351

shipping address:
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13 October 1976
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409 942

TO: Chief of Naval Research
Department of the Navy
Arlington, Virginia 22217

ATTN: Dr. R. D. Gaul
Code 102-OSC

SUBJ: Contract N00014-70-A-0166, Task 0016, Final Report
for the Period 1 July 1973 through 15 October 1974

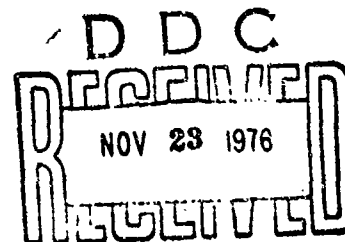
The work performed under Contract N00014-70-A-0166, Task 0016, for the period 1 July 1973 through 30 June 1974 was reported in the annual report Applied Research Laboratories Technical Report No. 76-31 (ARL-TR-76-31), 5 July 1976, by Glen E. Ellis, entitled "Summary of Environmental Acoustic Data Processing". The attached letter final report covers the contract period 1 July 1973 to 15 October 1974.

R. H. Wallace

R. H. Wallace
Associate Director

G. E. Ellis

G. E. Ellis, Head
Computer Science Division



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SUMMARY OF ENVIRONMENTAL
ACOUSTIC DATA PROCESSING

9 Final Report Under Contract N00014-70-A-0166; Task 0016 (NR 292-131)
Final rept. 1 Ju. 1973 - 15 Oct. 1974

10 By
Glen E. Ellis

15
N00014-70-A-0166-0016

INTRODUCTION

The work described in this letter report was performed under Contract N00014-70-C-0186, Task 0016, during the period 1 July 1973 through 15 October 1974. The areas of work performed were acoustic data processing development and modifications, environmental acoustic data processing and analysis, exercise planning, and technical support services. Specifically, the tasks were concerned with the BLAKE Test, the CHURCH ANCHOR Exercise, and the SQUARE DEAL Exercise.

The work is summarized in more detail in the annual report for this contract covering the period 1 July 1973 - 30 June 1974 (Ellis, 1976). This final report updates the summary of work effort through 15 October 1974.

SUS PROCESSING DIAGNOSTIC PLAN

The CHURCH ANCHOR and SQUARE DEAL Exercises were concerned with acquiring, processing, and the analysis of environmental acoustic data for two ocean areas. A large number of explosive signals (SUS) were used to measure acoustic propagation loss. Signals were received and recorded on a number of different systems. Subsequently, these data were processed by a number of different organizations.

An examination of the preliminary data processing disclosed a number of possible discrepancies and unusual features. These included:

- (1) Artifacts that correlated with the temporal variations in ambient noise were present in a number of the CHURCH ANCHOR propagation loss plots.

(2) Different propagation loss values were obtained from the same data set when processed at different facilities.

(3) Propagation loss measurements made with the WECO survey array were significantly lower than measurements made with the ACODAC system in the same general area of the SQUARE DEAL Exercise.

An investigation, referred to as a "diagnostic plan", planned by the staff of ARL/UT, USI, and WHOI was subsequently undertaken to investigate these matters. A final report was submitted to the LRAPP manager with the finding of this study.

In summary, it was found that by applying advanced analytical techniques the CHURCH ANCHOR data could be edited to remove spurious data which had been introduced by the combination of poor signal-to-noise ratio and ambient noise fluctuations. Some of the reasons for the different propagation loss values obtained by various organizations when processing recorded data were identified, and a statistical analysis was performed to establish probable accuracy levels. The difference in propagation loss measurements made with the ACODAC and the survey array was determined to be due, at least in part, to significantly different bottom loss conditions along two paths.

HIGH RESOLUTION cw STUDY

The high resolution cw study was completed and the results documented in memorandum form to the LRAPP manager. The short study consisted of a high resolution frequency analysis of selected ACODAC recorded SQUARE DEAL and CHURCH ANCHOR cw data. The purpose was to determine the significance of sidebands associated with received cw

signals, which are generated by surface reflections, in estimating propagation loss.

Three sets of ACODAC data were analyzed to determine the effect of the sideband energy leakage in the estimation of cw propagation loss. It was found in most cases that the acoustic sidebands were below the system noise level. In those cases where acoustic sidebands were observed the difference in estimated signal energy as a function of bandwidth was only a few tenths of a decibel.

It was recommended that the cw processing bandwidth for the SQUARE DEAL Exercise data remain at 0.25 Hz. This recommendation is especially applicable to the ACODAC data where the system frequency resolution is limited in the even numbered analog tape channels. This means that for high frequency data the propagation loss may be biased up or down by a few tenths of decibels depending on the processing system being used.

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